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ABSTRACT

The goal of writing assessment in the Department of Mathematics at Rochester Institute of Technology (RIT) is to assure that students can communicate about mathematics or statistics in a manner appropriate to their future careers. A five-member writing committee, composed of mathematics faculty, assess students at three different times during their four-to-five years of college study. During the first stage of assessment, students take a sequence of seminars in which they do many informal and a few formal writing assignments, one of which is assessed by the writing committee. In the second stage students must satisfactorily complete two theoretical courses which require students to write competently in the symbolic language of mathematics. In the final stage of assessment students write an in-depth technical report in an upper-division mathematics course. The committee assesses the papers as pass or fail based on effective communication at a level acceptable in a business environment. Students cannot graduate until their papers pass the final stage of assessment. Ongoing discussions in the writing committee address occasional problems in the evaluation system. Students who enter RIT as freshmen have a clear understanding of the goals of the writing policy. Transfer students, limited-English-speaking, and hearing-impaired students often experience difficulty with the requirements of the writing committee and need additional support. Virtually all mathematics majors find additional corroboration for the writing policy among their employers. (RS)

WRITING ASSESSMENT IN THE DEPARTMENT OF MATHEMATICS AT ROCHESTER INSTITUTE OF TECHNOLOGY

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The goal of writing assessment in the Department of Mathematics is to assure that students can communicate about mathematics or statistics in a manner appropriate to their future careers. This conforms to the overall institute goals for writing, as well as to the goal for writing competency set in the College of Science at RIT. Students in the department chose one of three major tracks, applied mathematics, applied statistics or computational mathematics (a combination of computer science and mathematics), but all one hundred thirty undergraduate majors must pass the same assessment criteria.

A five member Writing Committee, composed of mathematics faculty, assesses students at three different times during their four to five years of college studies. This committee is appointed by the Department Chair each year, and, for consistency, two or more faculty are reappointed to the committee for more than one year. The Writing Committee works closely with other mathematics faculty who teach the various content courses in which the committee evaluates students' written work.

Stage I of Assessment

First-year students are required to take a sequence of seminars (one credit each) designed to prevent attrition from the math program and to provide group work on problem solving, both from the perspective of mathematics and college survival. In Seminar I the students do many informal and a few formal writing assignments, one of which is assessed by the Writing Committee to give initial feedback to the students.

A typical one page paper from Seminar I would be the summary of an interview with a math professor. This first encounter with the Writing Committee is really a preparation for Seminar II where they will have a longer paper formally evaluated by the committee. The goal in both Seminar I and II is early feedback, early wake-up, and early alert to the fact that we, as well as future employers, are serious about good mathematical writing. Also, most students take English Composition in the first year, so it reinforces what they are learning there. Although the committee's evaluation has no weight in the grade for Seminar I, the students know that in Seminar II they cannot pass the course without passing the writing competency.

In the Winter Quarter of the first year, in Seminar II, the curriculum revolves around successful completion of step one of the writing competency. By the end of a ten week quarter students produce a two to four page technical report which is evaluated by the Writing Committee on a pass/fail basis. Leading up to the report, students work in groups to solve a simple mathematical modeling problem, do group presentations on their solutions, and agree upon a "best model" and "best solution" which the class as a whole is willing to accept. In preparation for the report, students prepare individual outlines, critique each others outlines, write first drafts, receive feedback from the instructor, and prepare two copies of a final report. The report is graded with a letter grade by the instructor as well as on a pass/fail basis by the Writing Committee.

Each report is read by two members of the writing committee, with split decisions given a third reading. Students who receive two failing grades have one week in which to seek assistance from a variety of sources including the course instructor, the committee members who read the paper, and the Writing Lab at the Learning Development Center before resubmitting their papers. Fairly extensive feedback on the failed paper has been provided by each reader of the paper, including the course instructor. Again the paper is read twice, and if the student fails a second time, he or she receives an incomplete in the course and must sign a contract with the course instructor which outlines how stage one of the writing competency will be satisfied.

At this time the instructor and the Writing Committee are looking to intervene early with students who have difficulty writing or who cannot articulate coherently about the mathematics they do understand. In severe cases, students will not complete the technical report, but rather will contract to complete appropriate work with the faculty of the Writing Department of the Learning Development Center. Students have two quarters in which to remove the incomplete from their grade record before it turns to an F.

Since I was the instructor for Seminar I and II for three years I can attest to how well this early intervention works in identifying students who will have difficulty passing the final stage of the writing competency as well as passing liberal arts and other classes with significant writing components. However, after identification of these students and satisfactory completion of a short term contract, few students continue working on recommended skill

building once the incomplete is removed from their grades. The ostrich mode of operation is very strong, particularly for technical students who disdain their liberal arts classes.

Stage II of Assessment

In the second stage students must satisfactorily complete two theoretical courses, Discrete Mathematics and Linear Algebra, thus showing that they can write competently in the symbolic language of mathematics. Although this may seem removed from what English professors consider "writing," mathematical language is highly structured and requires logical order, clarity, and precision. Most of the writing in these courses is formal proof writing, which is analogous to writing a clear essay: introduction, statements which support your thesis in a logical, consistent, and clear manner, and a conclusion which summarizes your proof. The notation is symbolic in character, but there is a correct syntax, analogous to English phrases and sentences, which must be followed. Corrections on a proof look very much like corrections on an essay -

"you can't support this statement from the previous evidence presented"

"this does not follow logically"

"this is unclear, confused or rambling"

"you are just restating the same idea and not developing the proof"

"this is not a mathematical sentence or statement"

Students find these courses difficult, but most learn the language with practice. Like any other type of writing, you cannot learn how to do it by reading a book, although reading clear proofs helps in learning how to construct proofs from scratch.

Stage III of Assessment

In the final stage of assessment students write an in-depth technical report in an upper division mathematics course. Students who major in Applied Mathematics or Computational Mathematics are evaluated in an advanced modeling course, while students who are Applied Statistics majors are evaluated in a class on the design

of experiments. The committee assesses the papers as pass or fail based on effective communication at a level acceptable in a business environment. As before, two Writing Committee members read each paper, with a split decision given a third reading. Students are given an opportunity to rewrite papers which fail, with assistance from all of the sources named previously, and may not graduate until this stage of the writing competency is passed.

In order to make stage III successful there must be clear communication between the faculty member teaching the course and the Writing Committee. Clearly the expectations of both must match for the student to feel comfortable with the process. Although much dialogue has taken place there are still glitches in the system. For instance, an ongoing question, yet to be resolved by the department as a whole, is whether the Writing Committee should be judging the mathematics in the paper or the exposition about the mathematics. Suppose the student uses an incorrect formula, but gives a well written discourse about what they have done? Should the Writing Committee fail the paper? How many mathematical errors should constitute failure?

Clearly many types of conflicts can arise, but the most common one is that the instructor gives a high grade to a report, based on sophisticated and logically presented mathematics, while the committee fails the paper based on grammar, sentence structure, and lack of English clarity. The second most common conflict is that two members of the Writing Committee give conflicting feedback to the writer. Rarely is the feedback in direct conflict, but while one mathematician may fail a paper for confusing terminology and general lack of clarity in the mathematical explanation, the second reader may emphasize the poor sentence structure and grammatical errors. Ongoing discussions in the Writing Committee are attempting to address these occasional problems in the system.

Student Reaction to the Writing Policy

Students who enter RIT as first year students have a clear understanding of the goals of the writing policy and see that it is taken seriously at all stages. They have been warned repeatedly during their first two years about the impending paper in an upper division class which could prevent them from graduating. A fair number of math faculty who are not involved with the Writing Committee employ some form of writing regularly in their classes. Some include one or more essay questions on tests or final exams

and others require technical papers or computer laboratory reports in courses which are not tied to the writing competency. Thus, over a four or five year period, the writing requirement for graduation seems consistent.

A group of students who have a fair amount of difficulty adjusting to the writing policy are transfer students. They miss the first year seminar courses and often have transfer credit for the symbolic language courses in the second phase of assessment, as well as for English Composition. Thus they may be surprized by the seriousness and high expectations in grading the technical report in stage three.

Another small group of students who have difficulty with all stages of the requirement are hearing-impaired math majors and math majors with limited-English-proficiency. Both groups struggle with all stages of the requirement and need additional support from a variety of services which are available on campus.

All the majors find additional corroboration of the policy among co-op employers. Virtually all students in the Department of Mathematics are employed for one or more quarters in business and industry doing paid work utilizing their mathematics and computer skills. Many students work for two or three different companies and in almost every case there is a strong emphasis on written and oral communication on the job. Once a student has heard from an employer that writing is important in a technical field, the work of the writing committee is legitimized in their eyes and our task becomes much easier.

I would now like to introduce Dr. Jeannee Sacken, Writing Co-ordinator for the National Technical Institute for the Deaf at RIT who will speak on alternative writing assessment for deaf and hard-of-hearing majors in the College of Business.